Acoustic Lab
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Australia

Measurement of Airborne Sound Insulation of Building Elements in Accordance with ISO10140, Weighted Sound Reduction Index (R_w) Calculation in Accordance with AS/NZS ISO 717.1

Performed on XCL003 wall

Date: 06/11/2013

Ordered by Xclude

14 Production Drive

Wauchope NSW 2446

Report 06112013/ct/01

Written by: C. Titry ***Date: 12/11/2013***	***Approved by: C. Titry*** ***Date: 12/11/2013***

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1. Relevant standards

The measurements leading to the results presented in this report have been undertaken in accordance with standards which specify a method for measuring the airborne sound insulation of building elements:

- *ISO10140-1:2010 Acoustics –Laboratory measurement of sound insulation of building elements – Part 1: Application rules for specific products*
- *ISO10140-1:2010/Amd.1:2012 Acoustics –Laboratory measurement of sound insulation of building elements – Part 1: Application rules for specific products—Amendment 1*
- *ISO10140-2:2010 Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation*
- *ISO10140-4:2010 Acoustics – Laboratory measurement of sound insulation of building elements – Part 4: Measurement procedures and requirements*

The calculation method leading to the rating of the sound insulation of the samples tested is defined in:

- *AS/NZS ISO 717.1:2004 Acoustics—Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation*

It uses the results of the tests defined in ISO 10140 to determine a single figure performance guide known as the "Weighted Average Sound Reduction Index", which is expressed in terms of a number of dB, followed by the suffix "R_w".

The test facility and equipment were in accordance with:

- *ISO10140-5:2010 Acoustics – Laboratory measurement of sound insulation of building elements – Part 5: Requirements for test facilities and equipment*

2. Testing facilities description

The test facility consists of two acoustically "live" reverberant rooms. The Source room has a volume of 72m^3 and the Receiving room a volume of 82m^3.

Both Source and Receiving rooms are independent constructions that are isolated from the ground by a high density glass wool blanket foundation.

The rooms are acoustically de-coupled from each other and the common specimen holder by a viscoelastic polyurethane mastic infill. Both rooms incorporate exposed elements that provide additional reflective surfaces to enhance sound diffusion within the room volumes.

A 2990mm wide x 2380mm high test specimen aperture separates the two rooms

3. Description of procedure

Measurements were undertaken by Christophe Titry (testing officer) and a representative of Xclude was present during testing.

Sample preparation

The test sample was installed within the aperture that separates the Source and Receiving rooms, an acoustically rated filler wall was constructed to accommodate the test specimen.

Noise generation

A "Pink Noise" was generated as the reference sound spectrum. It was amplified and fed through to the omnidirectional source unit which was used to evenly radiate sound in a spherical distribution. This unit consists of twelve individual loud speakers configured around a dodecahedron.

Sound pressure levels readings of Source room

Sound pressure levels (L1) were measured in the Source Room via a calibrated microphone attached to a rotating boom. The boom was set in motion and readings were continuously averaged and recorded throughout the sweep (Radius = 1.1m) which last for a period of one minute.

Sound pressure levels readings of Receiving room

The Microphone and boom were then moved into the receiving room and sound pressure levels (L2) were measured in the Source Room via a calibrated microphone attached to a rotating boom. The boom was set in motion and readings were continuously averaged and recorded throughout the sweep (Radius = 1.1m) which last for a period of one minute.

L1 and L2 were measured for two source locations. The tripod location in the receiving room stayed the same during the measurements.

Background Sound pressure levels readings in Receiving room

One background noise levels (B2) was measured in the Receiving room via a calibrated microphone. For this measurement the boom was in the static position. A continuous reading lasting thirty seconds was taken.

T2 Reverberation Time measurements

The Omni sound source was then moved into the Receiving room to undertake reverberation time measurements (T2). The sound field was built up within the Receiving room and abruptly cut off. The decay of the sound levels within the room was then measured. The build-up and decay readings were taken three times

This procedure was repeated with the microphone positioned at three different places within the room volume with two different sound source positions.

Measured L1, L2, B2 & T2 processing

Finally measurements results were processed in order to get the “Weighted Average Sound Reduction Index”, R_w.

Apparatus

Table 1 presents the list the apparatus used.

Table 1 - Apparatus used for measurements

Equipment	Manufacturer	Type
Acoustic Analyser	*Norsonic*	NOR140 Class 1 SLM S/N 1404977 Calibration due date January 2014
Microphone	*Norsonic*	1225 S/N 142515 Calibration due date January 2014
Preamplifier	*Norsonic*	1209 S/N 14250 Calibration due date January 2014
Acoustic software	*Norsonic*	Nor140/1, /3, /9, /10
Acoustic analysis software	*Norsonic*	Nor1028/03
Amplifier	*Brüel & Kjær*	2716 Power amplifier
Noise Source	*Brüel & Kjær*	4269 Omni direction loud speaker
Rotating microphone boom	*Brüel & Kjær*	3923
Sound Calibrator	*Brüel & Kjær*	4231 S/N 2558216 Calibration due date September 2014
Wireless Transmission	*Sennheiser*	eW 100 G2
Wireless Transmission	*Norsonic*	Nor520A
Digital Psychrometer	*Reed*	8706 S/N 9811576 Calibration due date March 2014

4. Tested product identification and description

The installed specimen was a wall composed of (from receiving to source room) 12mm Magnesium Oxide Board Corporation ResCom - 75mm steel studs filled with 24kg/m3 glasswool R2.0 Bradford Soundscreen - 25mm air gap - 200mm steel studs - 18mm Magnesium Oxide Board Corporation ResCom.

The internal frame was made of a double stud frame composed of 75mm (1mm thick) steel studs with 600mm centers and noggins at 1208.5mm from ground and 200mm (1.9mm thick) steel studs with 450mm centers.

Edges in contact with the sample holder were sealed with Sikaflex sealant.

5. Air temperature and humidity

Table 2 presents the air temperature and humidity for each measurement.

Table 2 Temperature and humidity summary

Test	Temp. Wet-bulb (°C) Src / Rec	Temp. Dry-bulb (°C) Src / Rec	Humidity (%) Src / Rec	Ref. #
Test #1	16.3 / 16.2	25.3 / 25.2	39.9 / 39.0	AC484WA11/2013

6. Sound Reduction index of the specimen

Table 3 presents the sound reduction index for the specimen.

Table 3 Sound reduction index for each 1/3 octave band

Frequency (Hz)	R (Sound Reduction Index) (dB)
	Test #1
	Ref. AC484WA11/2013
100	≥ 37.7‡
125	≥ 42.3‡
160	≥ 46.4‡
200	≥ 49.7‡
250	≥ 52.4‡
315	≥ 55.4‡
400	≥ 59.4‡
500	≥ 62.6‡
630	≥ 63.9‡
800	≥ 63.5‡
1000	≥ 65.1‡
1250	≥ 66.2‡
1600	64.5
2000	65.5
2500	67.4
3150	≥ 70.2‡
4000	≥ 74.9‡
5000	≥ 77.2‡
R_w	**62**

Table 4 presents the corrections details for the specimen (refers to symbol ‡ in Table 3).

Table 4 Corrections details for the specimen

Test	Frequency (Hz)	‡ symbol comment
AC484WA	100	R1 larger than R'max (44.9 dB) - 15 dB (No correction)
AC484WA	125	R1 larger than R'max (50.9 dB) - 15 dB (No correction)
AC484WA	160	R1 larger than R'max (58 dB) - 15 dB (No correction)
AC484WA	200	R1 larger than R'max (59.4 dB) - 15 dB (No correction)
AC484WA	250	R1 larger than R'max (59.9 dB) - 15 dB (No correction)
AC484WA	315	R1 larger than R'max (64.9 dB) - 15 dB (No correction)
AC484WA	400	R1 larger than R'max (68.5 dB) - 15 dB (No correction)
AC484WA	500	R1 larger than R'max (71.8 dB) - 15 dB (No correction)
AC484WA	630	R1 larger than R'max (74.1 dB) - 15 dB (No correction)
AC484WA	1200	R1 larger than R'max (75.3 dB) - 15 dB (No correction)
AC484WA	1000	R1 larger than R'max (76.3 dB) - 15 dB (No correction)
AC484WA	1250	R1 larger than R'max (80.3 dB) - 15 dB (No correction)
AC484WA	4000	R1 larger than R'max (87.3 dB) - 15 dB (No correction)
AC484WA	5000	R1 larger than R'max (81.2 dB) - 15 dB (No correction)
AC484WA	100	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	125	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	250	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	315	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	400	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	500	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	630	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	1200	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	1000	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	3150	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	4000	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	5000	R1 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	100	R2 larger than R'max (44.9 dB) - 15 dB (No correction)
AC484WA	125	R2 larger than R'max (50.9 dB) - 15 dB (No correction)
AC484WA	160	R2 larger than R'max (58 dB) - 15 dB (No correction)
AC484WA	200	R2 larger than R'max (59.4 dB) - 15 dB (No correction)
AC484WA	250	R2 larger than R'max (59.9 dB) - 15 dB (No correction)
AC484WA	315	R2 larger than R'max (64.9 dB) - 15 dB (No correction)
AC484WA	400	R2 larger than R'max (68.5 dB) - 15 dB (No correction)

Test	Frequency (Hz)	‡ symbol comment
AC484WA	500	R2 larger than R'max (71.8 dB) - 15 dB (No correction)
AC484WA	630	R2 larger than R'max (74.1 dB) - 15 dB (No correction)
AC484WA	1200	R2 larger than R'max (75.3 dB) - 15 dB (No correction)
AC484WA	1000	R2 larger than R'max (76.3 dB) - 15 dB (No correction)
AC484WA	4000	R2 larger than R'max (87.3 dB) - 15 dB (No correction)
AC484WA	5000	R2 larger than R'max (81.2 dB) - 15 dB (No correction)
AC484WA	100	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	125	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	250	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	315	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	400	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	500	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	630	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	1200	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	1000	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	3150	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	4000	R2 was within 6 dB under R'F (-1.3 dB correction for R)
AC484WA	5000	R2 was within 6 dB under R'F (-1.3 dB correction for R)

Annexe A – One-sheet report R_w

Sound reduction index, *R*, in accordance with ISO 10140-2

Area of separating element: 7.1 m²
Source room volume: 72 m³
Receiving room volume: 82 m³
Date: 6/11/2013
Client: Xclude

Humidity (%, S/R): 39.9 / 39.0 ±3
Temperature (Wb, °C, S/R): 16.3 / 16.2 ±0.6
Temperature (Db, °C, S/R): 25.3 / 25.2 ±0.6
Static pressure (hPa): 1022 / 1022 ±0.5%

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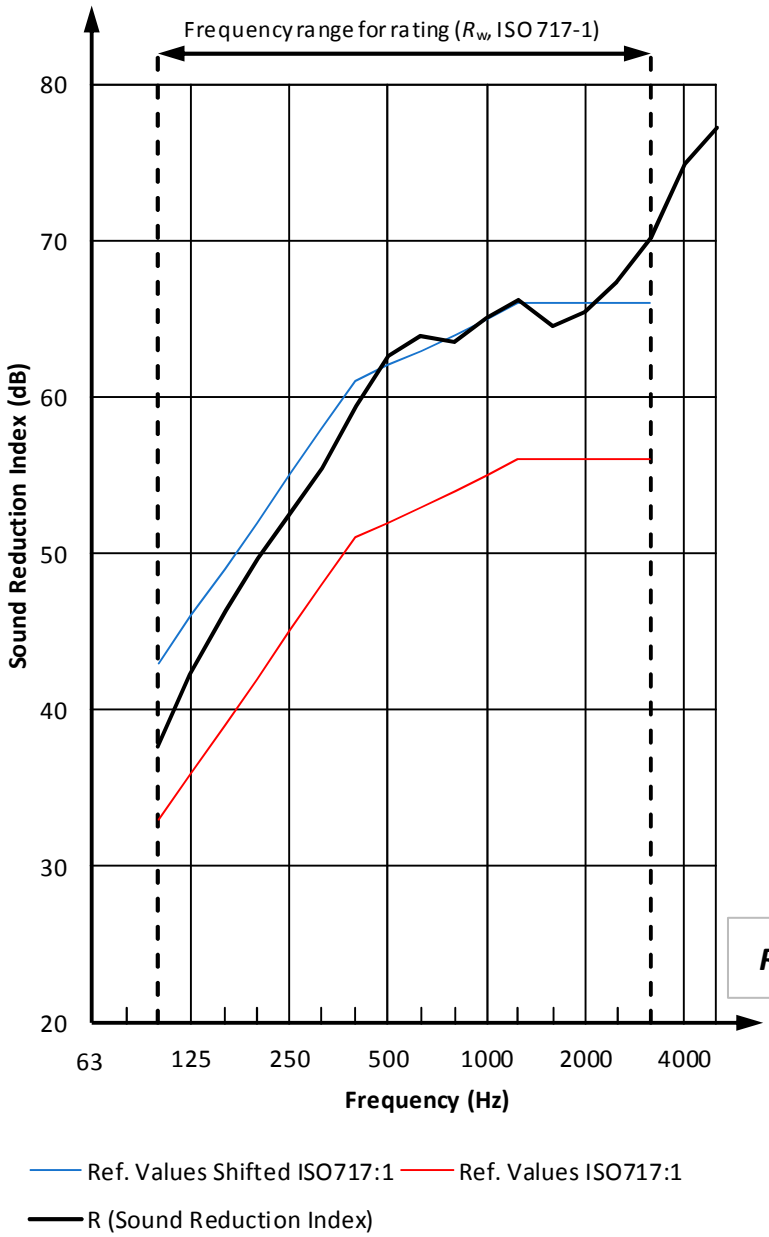

Frequency f Hz	*R* 1/3 octave dB
100	≥ 37.7‡
125	≥ 42.3‡
160	≥ 46.4‡
200	≥ 49.7‡
250	≥ 52.4‡
315	≥ 55.4‡
400	≥ 59.4‡
500	≥ 62.6‡
630	≥ 63.9‡
800	≥ 63.5‡
1000	≥ 65.1‡
1250	≥ 66.2‡
1600	64.5
2000	65.5
2500	67.4
3150	≥ 70.2‡
4000	≥ 74.9‡
5000	≥ 77.2‡

‡ : See report for details

$R_w(C;C_{tr})$ = 62 (-2;-7) dB

Evaluation based on laboratory measurement results obtained in one-third octave bands by an engineering method.

Wall: From receiving to source room: 12mm Magnesium Oxide Board Corporation ResCom - 75mm steel studs filled with 24kg/m3 glasswool R2.0 Bradford Soundscreen - 25mm air gap - 200mm steel studs - 18mm Magnesium Oxide Board Corporation ResCom

Frame: double stud frame composed of 75mm (1mm thick) steel studs with 600mm centers and noggins at 1208.5mm from ground and 200mm (1.9mm thick) steel studs with 450mm centers

Annexe B – Pictures and drawings of the samples

No drawings were provided by Xclude